# MiniLog
# Digital + 4-20mA + BattV + TempC Data Logger

## Model : ML1-420

## Operation Manual

HYDROLOGICAL SERVICES Pty Ltd
48-50 Scrivener Street
Liverpool NSW 2170
Australia
Ph. 61 2 9601 2022 Fax. 61 2 9602 6971
E-Mail: sales@hydrologicalservices.com

# TABLE OF CONTENTS


1. Introduction ..... 3

2. Product Overview ..... 4
2.1 Overview ..... 4

3. Installation ..... 4
3.1 Hardware Connections ..... 5
3.1.1 Contact Closure input ..... 6
3.1.2 External Power Supply ..... 6
3.1.3 4-20mA Transducer Input ..... 7
3.1.4 Communications ..... 7
3.2 Setup and Configuring the Logger ..... 9
3.2.1 Site Information ..... 9
3.2.2 System Time/Date ..... 9
3.2.3 Sensor + Parameters ..... 9
3.2.4 Communications ..... 10

4. Operation ..... 11
4.1 Commands / Syntax ..... 11
4.1.1 On-line Help (?) ..... 11
4.1.2 Communications (BAUD, EV, RE, CLEAR) ..... 12
4.1.3 Battery Voltage (BV, BVINT) ..... 13
4.1.4 Temperature (TEMPC) ..... 13
4.1.5 Digital Channel Parameters (CHID, INC, TDAY, TOT, TYPED, UD) ..... 14
4.1.6 4-20mA Channel Parameters (CHIDRV, RVHR, TXI, …..U420, WL) ..... 15
4.1.7 Date/Time Parameters (D, FMT, T, TA) ..... 17
4.1.8 Dump Log Records (DUR, DURV, ….DUALL, CLR, CLRV, MW, LOG) .. 18
4.1.9 Miscellaneous (ID, SI, PASSWD, BYE, SLEEP, RESET, VER) ..... 21
4.1.10 Status Window (ST) ..... 22
4.2 Data Output Format ..... 24
4.2.1 Dump Log Record ..... 24

5. Specification ..... 27
5.1 Hardware Specification ..... 27
5.2 LED Indicator ..... 28
5.3 External Contact Interface ..... 28
5.4 4-20mA Interface ..... 28
5.5 Communications Interface ..... 28
5.6 Watchdog ..... 28

6. Fault Finding ..... 30

Appendix A. Interfacing to a Modem ..... 32

Appendix B. Installing a RainTrak System ..... 35

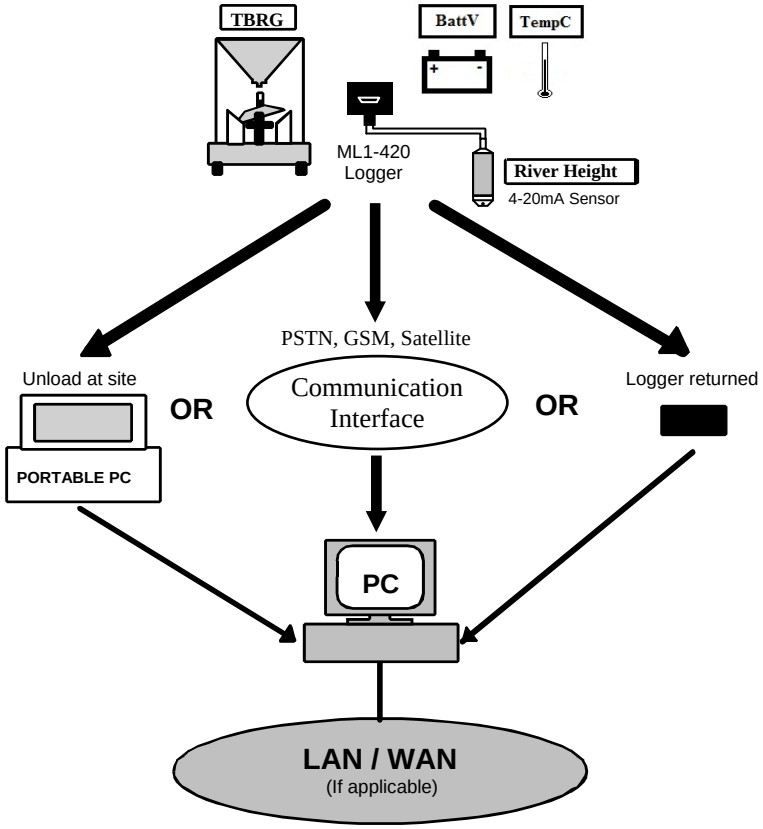
Appendix C. Surge Protection ..... 37



© Copyright

# 1. Introduction

The Hydrological Services MiniLog Data Logger ML1-420 has been designed using surface mount technology to provide a very small, ultra low power and reliable data logger that can be used in harsh environments for extended periods. Flash memory technology has not only been used for data storage but also for program storage - which provides secure non-volatile data storage as well as the unique capability of software download as new software features and revisions become available. The logger can be connected to a standard Tipping Bucket Rain Gauge OR any device that requires a contact closure to be monitored – it monitors the 4-20mA signal from a water level transducer, an external 12V battery, the internal battery and the ambient temperature inside the MiniLog enclosure. The communication features allow for very flexible operation directly connected to a computer. The unique on-board help feature allows the user to obtain a list of commands with syntax. The ultra low power allows the logger to be powered from an internal 3.6V AA lithium battery for 2 years or a 1.5V AA alkaline battery for 1 year. The indicator LED flashing once a second as a heartbeat, gives the user confidence that the MiniLog is alive and well.



# 2. Product Overview

## 2.1 Overview

The Hydrological Services MiniLog Data Logger is easily installed within many products due to its small size. Its primary purpose is to count contact closures and measure and log data from a 4-20mA sensor / transducer.

One such application would be inside a Tipping Bucket Rain Gauge, (TBRG). Rain falling on the collecting funnel is directed through a syphon control unit and discharges as a steady stream into a 2 compartment bucket mounted in unstable equilibrium. As each compartment fills, the bucket tilts alternately about its axis. Each tip forces a contact closure of a magnetic reed switch corresponding to a height of rainfall depending on bucket capacity, (Bucket Capacity can be 0.2 mm, 0.5 mm, 1.0 mm, 0.01 inch). The logger unit accepts the contact closure and records the event as a time stamp to one second resolution. Each event is stored in secure, non-volatile flash memory.

At the same time the logger can measure water level using a 4-20mA pressure transducer. The logger switches the external 12V battery voltage to the 4-20mA loop, and waits the required warmup period, takes a measurement of the 4-20mA current, turns off the loop power, scales the result and saves each measurement in secure, non-volatile flash memory in preparation for data extraction.

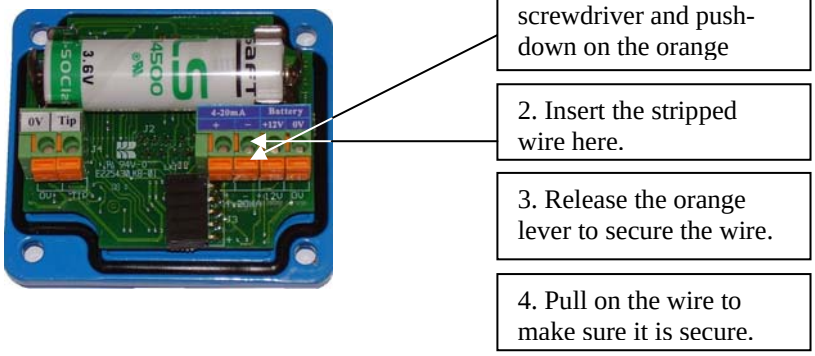
The data extraction process is accomplished via a PC or similar. A simple one-to-one DB9 cable connection is made between the PC and logger to allow data retrieval upon operator command. The data format of the logger file is specified within this document.

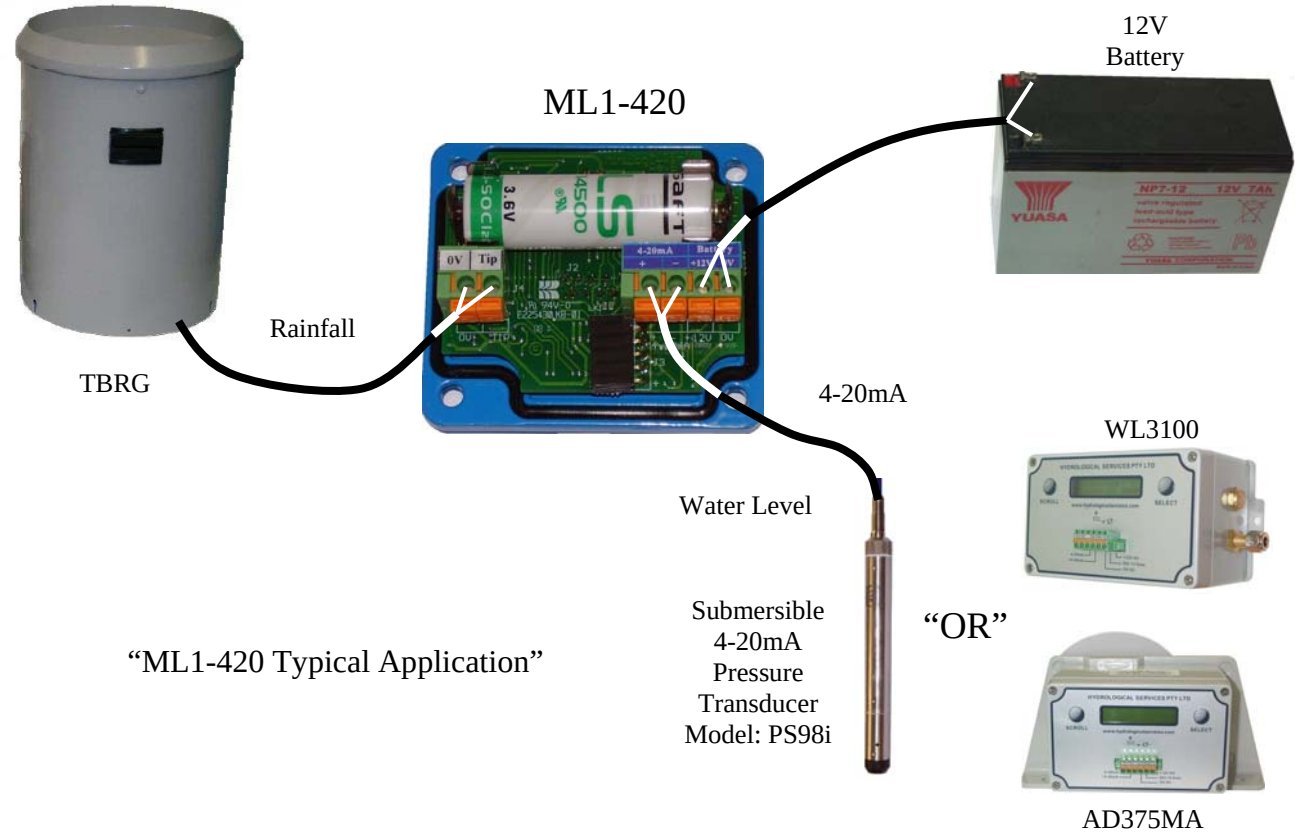
© Copyright

# 3. Installation

The MiniLog has a single DB9 female connector, which is mainly used for communications – (the digital input and external power may be taken through this connector, making it pin compatible with the ML1). The pinout is designed to be compatible with direct connection to a PC Comm port. Note that when external power is supplied, whether though an external 12V battery or RS232 handshake lines, the power drawn from the internal battery is reduced to zero.

The digital input from the TBRG, external 12V power and the 4-20mA transducer are connected to the internal screwless terminal blocks – these specific terminals are used because they keep a constant tension on the wires that are inserted.


1. Use a small flat blade screwdriver and push-down on the orange
2. Insert the stripped wire here.
3. Release the orange lever to secure the wire.
4. Pull on the wire to make sure it is secure.



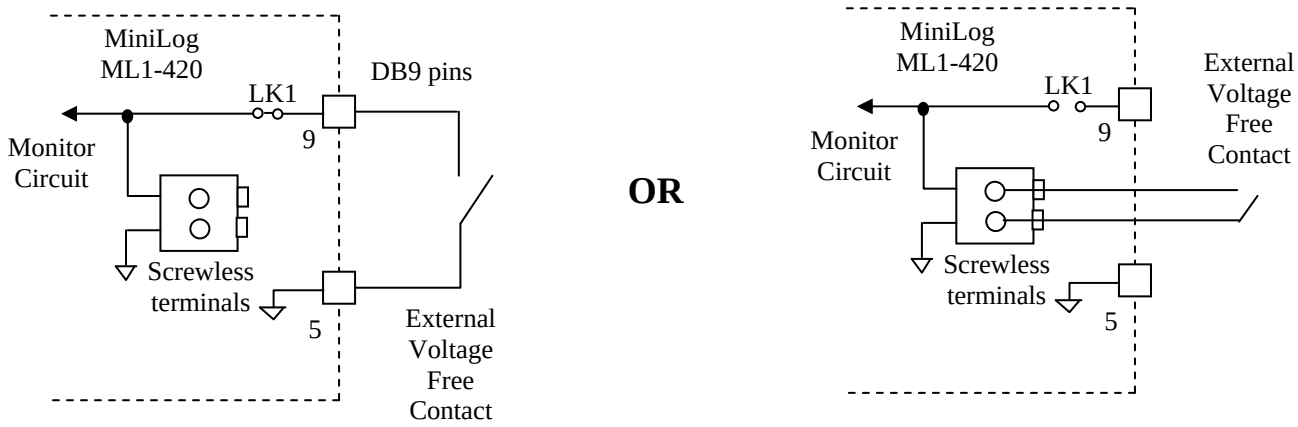

"ML1-420 Typical Application"


© Copyright

## 3.1 Hardware Connections

### 3.1.1 Contact Closure input

The voltage free contact to be monitored should be connected either between Pin 9 (contact closure input) and Pin 5 (Gnd) with PCB solder link LK1 bridged OR it can be connected to the internal screwless terminal block, through a cable gland on the enclosure. (**Note** that the PCB solder link LK1 is an option that is left open circuit when the ML1-420 is supplied from the factory.) (**Also Note:** In the first option (shown on the left), an extra tip will be generated when the DB9 connector is plugged into a PC, unless pin 9 is clipped on the DB9 lead.)




***Connection of Contact Closure Input***

### 3.1.2 External Power Supply

While the MiniLog ML1-420 is in the field monitoring a 4-20mA transducer, an external 12V power source **must be** connected to provide power to the transducer. The logger switches the 12V to the transducer, and waits for the preset warmup period (as set by the TXI parameter), and then measures the 4-20mA current that is passing through the sense resistor. The logger only uses the internal battery for maintaining the time while there is no external power source present.

The ML1-420 draws power from the RS232 signals for communications when there is no external power source present. (Note that this is not sufficient to power a 4-20mA transducer.)

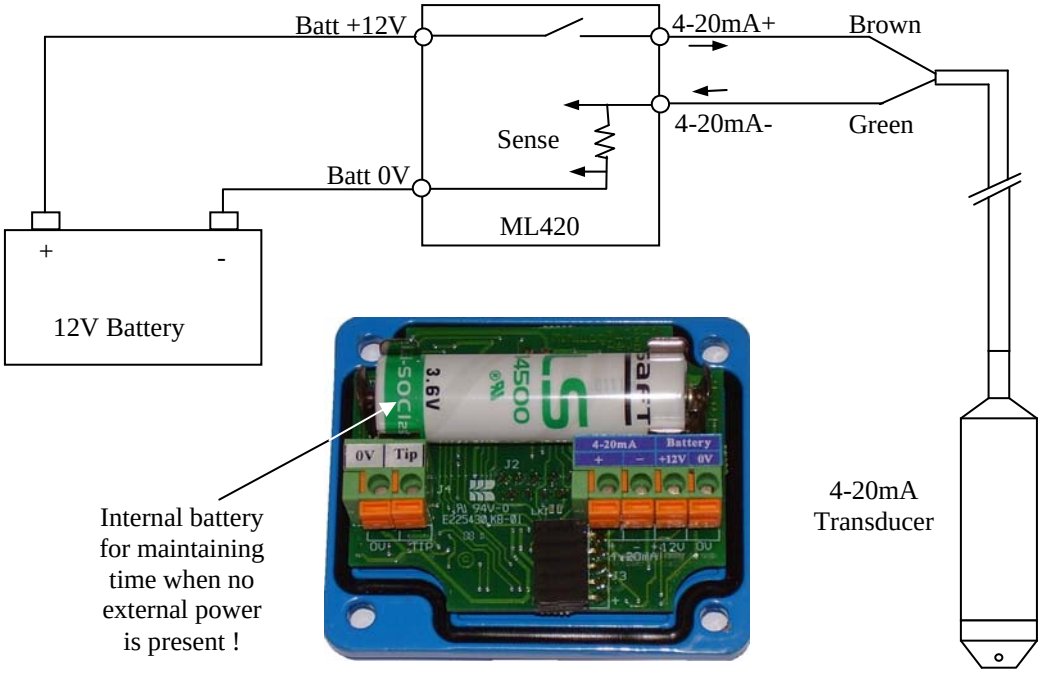
The internal and external voltage is measured and logged periodically by the logger. The logging interval is set with the "BVINT" command, which can be set from 1 to 999 minutes. The logged data can be retrieved with the DUBVI (internal battV) command, DUBVE (external battV) command, DUBVT (battV and tempC) command or the DUALL (dump All) command.

While the MiniLog ML1-420 is in the field monitoring the contact closure only, an external power supply is **not** required. The logger enters a "sleep" mode, waking only to update the time, and log a contact closure event. In this mode the logger will operate continuously for 2 years on the internal 3.6V lithium battery (or 1 year on a 1.5V alkaline battery).


© Copyright

### 3.1.3 4-20mA Transducer Input

The 4-20mA connection is via 2 wires into a screwless terminal block. The battery voltage is switched to the 4-20mA transducer and the current is measured across an internal sense resistor.




***Connection of 4-20mA Transducer***

### 3.1.4 Communications

The pinout of the DB9 female connector on the front of the ML1-420 logger is as follows :-

| Pin Connection | ML1-420 Logger Signal Name DB9 Female | | PC Signal Direction | PC Signal DB9 Male |
|---|---|---|---|---|
| 1 | No Connection | | ⇨ | CD |
| 2 | Tx (RS232 Serial data output) | | ⇨ | Rx |
| 3 | Rx (RS232 Serial data input) | | ⇦ | Tx |
| 4 | External Power (+ DTR / DSR loop) | | ⇦ | DTR |
| 5 | Gnd | | | Gnd |
| 6 | External Power (+ DSR / DTR loop) | | ⇨ | DSR |
| 7 | External Power (+ RTS / CTS loop) | | ⇦ | RTS |
| 8 | External Power (+CTS / RTS loop) | | ⇨ | CTS |
| 9 | Contact closure input (See note 3) | | ⇨ | RI |

**Notes:**

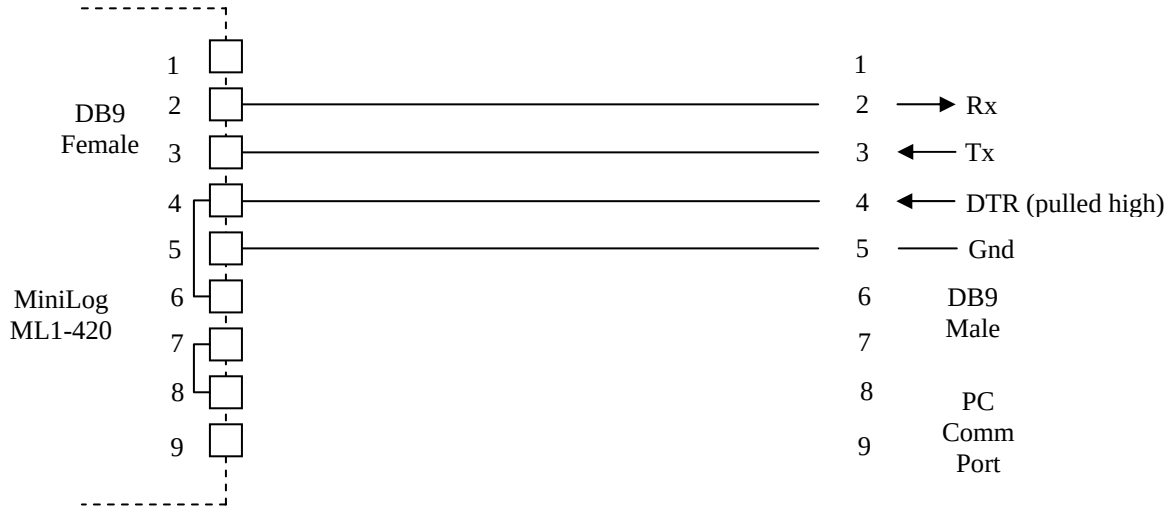
1. When the ML1-420 is directly connected to a PC the following handshake signals are linked
   - Pins 4 and 6 are linked together inside the ML1-420.
   - Pins 7 and 8 are linked together inside the ML1-420.


© Copyright

2. When the ML1-420 is directly connected to a PC, sufficient power is extracted from the handshake signals to power the ML1-420 – which prevents power drain from the internal battery while communications is in progress.

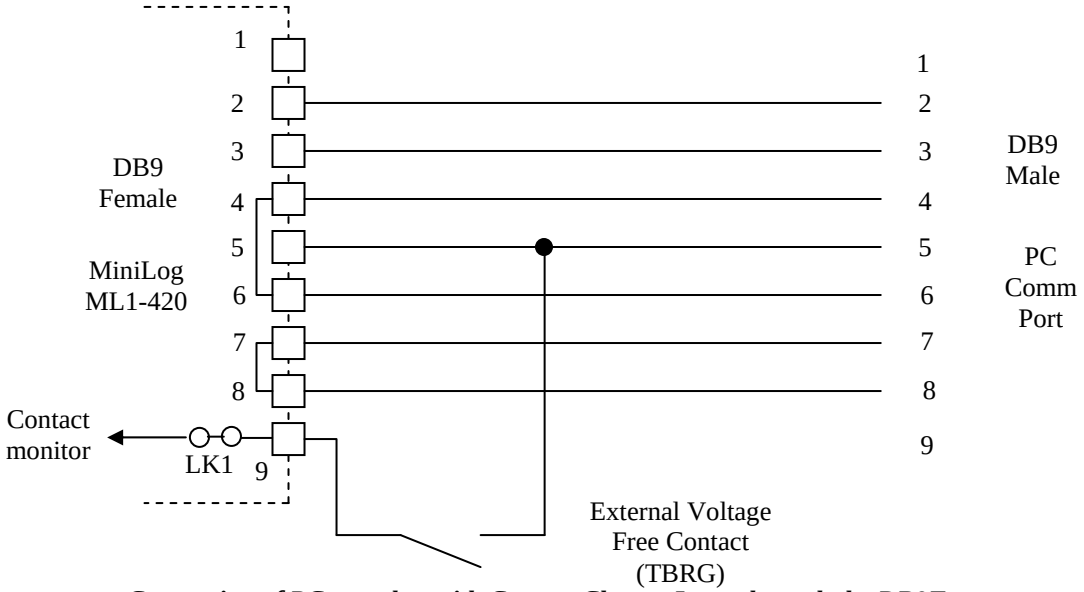
3. A solder link LK1 on the ML1-420 PCB allows the digital input from the TBRG to be connected through pin 9 of the DB9F connector. See section 3.1.1 for more details.

The DB9 female connector on the logger is the communications port and is setup as a DCE. This allows direct connection to a PC comm port using a DB9 male to DB9 female 1-to-1 cable. (The minimum connection is pins 2, 3, 4 and 5.)




***Minimum Connection of PC on DB9F***

Communications can also be active while the contact closure input on pin 9 is used when jumper LK1 is soldered, and a special cable is prepared.




***Connection of PC together with Contact Closure Input through the DB9F***

## 3.2 Setup and Configuring the Logger

Once the ML1-420 logger has been connected to a computer, the parameters can be setup using WinComLog or any 'dumb' terminal emulation program. (NOTE: If a third party application is used, the handshake signals DTR and RTS should be forced high to enable the MinLog to have power.) If using a third party program, it should be set for the appropriate baud rate, and 8/N/1 (bits/parity/stop), handshake off, and "local echo on". On receipt of individual commands from the computer, the logger will respond with the present parameter setting. (Note that the command keywords permit both upper and lower case characters, or a combination of both.) A carriage return ( < CR > , Enter Key) immediately following an entry will action the command. Invalid entries return a "Command Error" response. A list of all logger commands may be viewed on the computer screen by using the unique on-board help system. Simply type ? and then press the Enter key.

Data and parameter security is provided by means of a user password. Any data or parameters may be viewed without a password, but parameters may only be altered and data may only be cleared after the password has been entered correctly. The default password when the logger is supplied is "BOMM". Parameters may be entered by typing the command, then the equals symbol (=) and then the new parameter, followed by the Enter key.

### 3.2.1 Site Information

The "Site Information" (SI) is a user definable 16 character string that allows each logger to have a unique location name. Alternatively, loggers in a locality may be given the same name and the rainfall channel ID may be used to uniquely identify the logger data. This allows for easy identification of dumped data or status window information. See section 4.1.8 for more information on this command.

### 3.2.2 System Time/Date

The "Time" (T) and "Date" (D) should be checked for accuracy during installation.

The "Time Adjust" (TA) command allows the Real Time Clock to be adjusted for crystal frequency inaccuracies.

### 3.2.3 Sensor + Parameters

The Minilog ML1-420 has several parameters that allow characterisation of the sensor being used. The "Channel ID" (CHID) is a 7 digit user definable number that should be set to uniquely identify the digital (rainfall) channel. The "Increment" (INC) parameter defines the capacity of the specific digital sensor used as well as the number of external events that constitute one logged event - this determines the digital input resolution.
The "River Channel ID" (CHIDRV) is a 7 digit user definable number that should be set to uniquely identify the 4-20mA (river) channel. The "Transducer Range" (TXR) parameter defines the 4-20mA Range of the transducer. The "Transducer Interval" (TXI) parameter defines how often a transducer measurement is taken, and how long the transducer is powered for. The "River Height Ref" (RvHR) parameter defines the offset of the water height.
See section 4.1.4 for more information on these commands.


© Copyright

### 3.2.4 Communications

The MiniLog ML1-420 has an RS232 serial interface to support asynchronous ASCII communications to accommodate data extraction and user set-up. This port operates at 1200, 2400, 4800, 9600, 19200, 38400 and 57600 baud with 8 data bits, no parity and 1 stop bit.

If initially you can't establish communications with the ML1-420, try each of the 7 baud rates, in case it has been changed from the default rate of 9600.

Each digital input event, and 4-20mA measurement that is logged is also transmitted on the serial port, unless the event output flag is off (EV=off).

The RS232 serial port interface may be connected to a modem for remote interrogation and data retrieval – see Appendix A for more details.


© Copyright

# 4. Operation

## 4.1 Commands / Syntax

The following sections give detailed information on each of the MiniLog ML1-420 commands. Simply type the command and then press enter to view the parameter. To change a parameter, the password must first be entered, and then type the command followed by =, then the new parameter followed by Enter. Eg. SI=Sydney then press Enter.

### 4.1.1 On-line Help (?)

Type a **?** then press Enter to get the following help screen. The commands are listed in alphabetical order.

***On-line Help***

```
?
ML1-420 Data Logger Command Syntax          [...] = optional to set parameter
(Command may be upper and/or lower case)      <CR>  = press carriage return
======== General Commands ================================================
BAUD[=xxxx]<CR>      (comms BAUD rate)      BYE<CR>                (exit passwd access)
CLEARx[=30char]<CR>  (Clear Seq.x=1,2,3,4)  D[=d/m/y OR m/d/y]<CR> (Date)
EV[=On/Off]<CR>      (EVent output)         FMT[=dmy/mdy]<CR>      (date ForMaT)
ID<CR>               (logger ID)            LOG[=On/Off]           (En/Disable Logging)
MW[=On/Off]<CR>      (Memory Wrap)          PASSWD=****<CR>        (4 char password)
RE[=On/Off]<CR>      (REsponse output)      RESET<CR>              (software RESET)
SI[=16chars]<CR>     (SIte name)            SLEEP[=N]<CR>          (Set Sleep time mins)
ST<CR>               (STatus window)        T[=hh:mm:ss]<CR>       (Time)
TA[=hh:mm:ss]        (Time Adjust)          VER<CR>                (s/w VERsion)
======== Battery Voltage and Temperature Commands ============================
BV<CR>               (Batt. Voltages now)   BVINT[=mmm]            (BV/TempC log INTerval)
TEMPC<CR>            (TEMPerature oC now)
======== Digital Input Commands ==========================================
CHID[=7 dig]<CR>     (CHannel ID - Digital) INC[=x.x/mm]<CR>       (INCrement+mult.)
TDAY<CR>             (Total toDAY)          TOT<CR>                (TOTal)
TYPED[=16chars]<CR>  (TYPE of Dig i/p)      UD[=8char]<CR>         (Units Digital)
======== 4-20mA Input Commands ===========================================
CHIDRV[=7 dig]<CR>   (CHannel ID – 4-20mA)  RVHR[=xxx.xxx]<CR>    (RiVer Height Ref)
TXI[=mmm/tt]<CR>     (Transducer Interval)  TXR[=xxx.xxx]<CR>     (Transducer Range)
TYPE4[=16chars]<CR>  (TYPE of 4-20 logger)  U420[=8char]<CR>       (Units 4-20)
WL<CR>               (Water Level now)
======== Dump/Clear Commands ============================================
CLR<CR>              (Clear all Records)    CLRV<CR>               (Clear all Records)
DUR/N/h:m/d/m/y<CR>  (DUmp Rain log)        DURV/N/h:m/d/m/y<CR>   (DUmp RiVer log)
DUBVI[....]<CR>      (DUmp BattV.Internal)  DUBVE[....]<CR>       (DUmp BattV.External)
DUTMP[....]<CR>      (DUmp TempC)           DUBVT[....]<CR>       (DUmp BattV+TempC)
DUALL[....]<CR>      (DUmp ALL Data)        (All dump commands have the same syntax)
eg.  DUR                    => Dump all Rainfall data
     DUR/3                  => Dump last 3 days of Rainfall data
     DURV/10/12:00/15/2/11  => Dump 10 days of River data from 12:00 15-Feb-11
-------------------------------------------------------------------------------------------------------------
Water Level (WL) = (((Measured 4-20mA)-4)/16) x Range (TXR) + Offset (+/-RVHR)
```


© Copyright

## 4.1.2 Communications (BAUD, EV, RE, CLEAR)

The "Baud" (**BAUD**) command allows the baud rate to be viewed or changed. Acceptable baud rates are 1200, 2400, 4800, 9600, 19200, 38400 and 57600.

| | |
|---|---|
| BAUD<CR> | Display the present baud rate |
| BAUD= 9600<CR> | Set the baud rate to 9600 baud |

The "Event" (**EV**) flag allows the time stamps that are transmitted on the serial port to be enabled or disabled. When an event occurs, the time is transmitted on the serial when EV is on. When EV is off, nothing is transmitted on the serial port when an event occurs.

| | |
|---|---|
| EV<CR> | Display the state of the event flag. |
| EV=ON<CR> | Enable event reporting |
| EV=OFF<CR> | Disable event reporting |

The "Response" (**RE**) flag allows the error response to commands, to be enabled or disabled. When RE is on then you may see "Command Error" or "Syntax Error" messages appear if the MiniLog does not understand what was typed. When RE is off then there will be no response if the MiniLog does not understand what was typed. It is useful to turn this off when connected to a modem, so that the MiniLog and the modem don't engage in endless "Command Error" conversations.

| | |
|---|---|
| RE<CR> | Display the state of the response flag. |
| RE=ON<CR> | Enable all error responses. |
| RE=OFF<CR> | Disable all error responses. |

The "Clear" (**CLEAR1/2/3/4**) command sequences are used to control an external modem – that is, force it into a known state. (If there is no modem connected to your MiniLog, then these sequences can be left clear. Eg. Set CLEAR1=<CR> then CLEAR2=<CR> then CLEAR3=<CR> and finally CLEAR4=<CR>)

The Clear sequences are performed when a Bye command is received, and/or if no comms is received within the Sleep timer period.

There is a maximum of 30 characters in each of the 4 clear sequences. Special characters include ~ = 0.5 second pause and ^ = CTL character (Eg ^M = carriage return)
The format of each sequence is CLEAR1 = Command Sent / Expected Reply / Timeout


© Copyright

Eg **CLEAR1=+++~~ATH^M/OK/10** Sends +++, then waits 1 second, then send ATH<CR> then waits up to 10 seconds for an OK response.

The expected reply and the timeout parameters are optional. If no timeout is specified, then a default of 60 seconds is used. The timeout may be a one or two digit number.

| | |
|---|---|
| CLEAR1<CR> | Display the clear1 sequence |
| CLEAR1=+++~~<CR> | Set the clear 1 sequence. Send +++ then wait 1 sec |
| CLEAR1=+++//5<CR> | Send +++, no response and wait 5 seconds |

After CLEAR1 sequence is performed, CLEAR2 then CLEAR3 and finally CLEAR4 sequence is performed.

### 4.1.3 Battery Voltage (BV, BVINT)

The MiniLog battery voltage is measured and displayed when the battery voltage command (**BV**) is executed as well as during a status window command (**ST**)

| | |
|---|---|
| BV<CR> | Displays the internal and external battery voltages |

The battery voltage log interval can be set with the (**BVINT**) command from 1 to 999 mins. The internal battery, external battery and temperature are logged at this interval. The logged data can be retrieved using the DUBVI, DUBVE, DUBVT and DUALL commands.

| | |
|---|---|
| BVINT<CR> | Displays the log interval in mins. |
| BVINT=015<CR> | Set the battery and temperature log interval to 15 mins. |

### 4.1.4 Temperature (TEMPC)

The MiniLog tempearture is measured and displayed when the temperature command (**TEMPC**) is executed as well as during a status window command (**ST**)

| | |
|---|---|
| TEMPC<CR> | Displays the internal temperature in degrees C |

The temperature log interval is be set with the (**BVINT**) command above, from 1 to 999 mins. The internal battery, external battery and temperature are logged at this interval. The logged temperature can be retrieved using the DUTMP, DUBVT and DUALL commands.


© Copyright

### 4.1.5 Digital Channel Parameters (CHID, INC, TDAY, TOT, TYPED, UD)

The "Channel ID" (**CHID**) is a 7 digit user definable number that should be set to uniquely set to identify the channel.

| | |
|---|---|
| CHID<CR> | Displays the present Digital Channel ID |
| CHID=0012345<CR> | Sets the Digital Channel ID to 0012345 |

---

The "Increment" (**INC**) is a parameter that specifies the quantity that each contact closure represents. This might be 0.2mm of rain for a tipping bucket rain gauge, or 10 litres of water for a flow meter, or 1 widget for a product counter. The parameter is split into 2 parts – the first part is the amount that each contact closure represents, and the second part is the number of contact closures that represent one event. The increment command has 5 different acceptable formats.

| | |
|---|---|
| INC<CR> | Display the existing increment parameter. |
| INC=0.01/01<CR> | Defines say a TBRG bucket of 0.01 inches of water, and one tip represents one logged event. |
| INC=0.2/01<CR> | Defines say a TBRG bucket of 0.2 mm of water, and one tip represents one logged event. |
| INC=10/10<CR> | Defines say 10 litres of water per contact closure of a flow meter, and 10 such closures logged as one event. This means that each event represents100 litres of water. |
| INC=100/01<CR> | Defines say 100 litres of water per contact closure of a flow meter, and 1 such closure logged as one event. |
| INC=1000/05<CR> | Defines say 1000 washers in a box, and 5 such boxes logged as one event. This means that each event represents 5000 washers. |

---

The "Total" (**TOT**) command allows the Total number, of whatever is being counted, to be displayed. This is the total since the last reset – or the total since the last CLR record clear.

| | |
|---|---|
| TOT<CR> | Displays the total of what is being counted since the last record clear. |

---

The "Total Today" (**TDAY**) command allows the Total number, of whatever is being counted, to be displayed. This is the total today since midnight.

| | |
|---|---|
| TDAY<CR> | Displays the total of what is being counted since midnight. |


© Copyright

The "Type Digital" (**TYPED**) is a 16 character user defined string that allows the Status Window to be customised for your counting application. It simply changes the aesthetics of the Status Window. The MiniLog may be used for accumulating Rainfall, measuring Flow, counting People or Cars etc…. It is best to start this parameter with a capital letter – for aesthetic reasons.

| | |
|---|---|
| TYPED<CR> | Display the digital channel Type |
| TYPED=Rainfall<CR> | Set the digital type to Rainfall |
| TYPED=Flow<CR> | Set the digital type to Flow. |

The "Units Digital" (**UD**) is a user defined 8 character string that assists in defining what is being counted. For example it may be mm or inches or litre/hr or widgets. This parameter is so the retrieved data has meaning.

| | |
|---|---|
| UD<CR> | Display the present units. |
| UD=mm<CR> | Set the units to mm. |

### 4.1.6 4-20mA Channel Parameters **(CHIDRV, RVHR, TXI, …..U420, WL)**

(CHIDRV, RVHR, TXI, TXR, TYPE4, U420, WL)

The "Channel ID River" (**CHIDRV**) is a 7 digit user definable number that should be set to uniquely set to identify the 4-20mA channel.

| | |
|---|---|
| CHIDRV<CR> | Displays the present 4-20mA Channel ID |
| CHIDRV=0012345<CR> | Sets the 4-20mA Channel ID to 0012345 |

The "River Height Reference" (**RVHR**) is a parameter that is an "offset" added to the river height as measured by the transducer.

| | |
|---|---|
| RVHR<CR> | Display the present River Height Reference. |
| RVHR=5.000<CR> | Sets the offset to 5.000 m |
| RVHR= –520.000<CR> | Sets the offset to –520.000 m |

The "Transducer Interval" (**TXI**) is a parameter that defines the frequency that analog measurements are made, as well as the time that the transducer is powered before a measurement is made.

| | |
|---|---|
| TXI<CR> | Displays the present Transducer Interval. |
| TXI=015/07<CR> | Set to measure the transducer every 15 minutes, and leave the |


© Copyright

transducer powered for 7 secs before measuring. Transducer will be powered at 00:00, 00:15, 00:30, 00:45, 01:00, 01:15,….

---

The "Transducer Range" (**TXR**) is a parameter that defines the 20mA transducer depth. Zero depth is usually represented by 4mA and maximum depth is represented by 20mA. This parameter is determined by the particular transducer connected to the ML1-420.

| | |
|---|---|
| TXR<CR> | Displays the present Transducer Range. |
| TXR=10.000<CR> | Set the 20mA depth to 10.000m |
| TXR=1.000<CR> | Set the 20mA depth to 1.000m |

---

The "Type 4-20mA" (**TYPE4**) is a 16 character user defined string that allows the Status Window to be customised for your measurement application. It simply changes the aesthetics of the Status Window. The MiniLog may be used for measuring River Level, Dam Level, etc…. It is best to start this parameter with a capital letter – for aesthetic reasons.

| | |
|---|---|
| TYPE4<CR> | Display the MiniLog Type |
| TYPE4=River<CR> | Set the logger to River |
| TYPE4=Dam<CR> | Set the logger to Dam. |

---

The "Units 4-20mA" (**U420**) parameter is a user defined 8 character string that assists in defining what is being measured. For example it may be mm or inches or litre/hr or widgets. This parameter is so the logged data has meaning.

| | |
|---|---|
| U420<CR> | Display the present units. |
| U420=m<CR> | Set the units to m. |

---

The "Water Level" (**WL**) command initiates an analog measurement of the 4-20mA transducer and displays the result to 3 decimal places. The message "Please Wait…" will appear while the transducer is warming up prior to the actual measurement.

WL<CR>
Please Wait…
12.981

The Water Level value displayed is created as follows :
Water Level (WL) = (((Measured 4-20mA)-4)/16) x Range (TXR) + Offset (RVHR)

The result displayed when a WL command is performed is also logged into memory with the time.

---


© Copyright

## 4.1.7 Date/Time Parameters (D, FMT, T, TA)

The MiniLog date and time is maintained by the microprocessor, and the LED flashing once a second indicates that the logger is alive and operational. (This flash is only 1mS in duration and consequently the power consumption is negligible.)

The "Date" (**D**) is displayed as day/month/year or month/day/year with slash separators. (This depends upon the format (**FMT** ) parameter.)

| | |
|---|---|
| D<CR> | Displays the date. |
| D=22/09/05<CR> | Set the date. (Note: leading zeros are optional, BUT |
| D=9/3/5<CR> | day+month+year must be entered) |

The "Format"(**FMT**) parameter is used to change the date format to either day/month/year or month/day/year.

| | |
|---|---|
| FMT<CR> | Display the present format as "dmy" or "mdy" |
| FMT=dmy<CR> | Set the date format to day/month/year. |
| FMT=mdy<CR> | Set the date format to month/day/year |

The "Time" (**T**) is displayed in 24 hour format separated by colons. When entering the time and date, all fields must be entered. Note that if the time is entered as T= then it will be reset to midnight 00:00:00.

| | |
|---|---|
| T<CR> | Displays the time in 24 hour format |
| T=9:45:00<CR> | Set the time (Note: leading zeros are optional BUT |
| T=16:7:0<CR> | hrs+mins+secs must be entered) |

The "Time Adjust" (**TA**) command performs the same function as the time (T) command, except it determines if the clock is running fast or slow, and calculates an adjustment to add or subtract 1 second every xxx hours. In effect, this is a software adjustment to bring the clock into specification. A sample procedure would be :

1. Set the time accurately using the T=12:35:00<CR> command
2. Wait at least 12 hours (the longer the time period the better the accuracy – this could be over many months.)
3. Set the time again using the TA=17:13:30<CR> command


© Copyright

The new time adjustment will be calculated and displayed. (NOTE: If there is already a time adjustment in progress, then the MiniLog will take this into account when calculating the new adjustment.) After this procedure the clock accuracy will be improved considerably.

| | |
|---|---|
| TA<CR> | Display the present time adjustment<br>eg. +1 Sec every 0014 hours |
| TA=<CR> | Remove the existing time adjustment. |
| TA=10:13:55<CR> | Set the time to 10:13:55 and calculate the new time adjustment. |

### 4.1.8 Dump Log Records **(DUR, DURV, ….DUALL, CLR, CLRV, MW, LOG)**

(DUR, DURV, DUBVI, DUBVE, DUBVT, DUTMP, DUALL, CLR, CLRV, MW, LOG)

The MiniLog ML1-420 logged data is stored in the on-board flash memory.

The "Dump Rain log" (**DUR**) command, unloads the historical records from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear rain log user command (**CLR**) – please note that the CLR command clears all logged data, rain, river, battery and temperature!! When the memory becomes full, with Memory Wrap off, the logger stops logging and tacks a "Mem Full" message onto the end of an event message. When Memory Wrap is on, and memory becomes full, the oldest records are erased and replaced by the newest records. The log is dumped in ascii format, as shown in section 4.2.1.

| | |
|---|---|
| DUR<CR> | Dump the complete rain log record. |

The "DUR" command also allows for searching through the log and starting at a specific location instead of always dumping the complete log record.
Syntax : DUR / No of days / Time / Date

Examples :

| | |
|---|---|
| DUR/2<CR> | Dump 2 full days of data, starting 2 days back from the current date at 00:00 |
| DUR/1/1:40<CR> | Dump 1 day of data starting at 1:40am today |
| DUR/30/12:00/1/1/11 | Dump 30 days of data starting at 12:00pm on 1-Jan-2011 |
| DUR/12/15:30/13 | Dump 12 days of data starting at 3:30pm on the 13th day of the current month and year. (Note that the date format in this example is Day/Month/Year) |
| DUR/L | Dump all the data since the last dump |

**NOTE :** The format of the date in the DUR command depends upon the date format in the MiniLog – that is either Day/Month/Year or Month/Day/Year.


© Copyright

The "Dump Internal Battery Voltage log" (**DUBVI**) command, unloads the internal battery voltage log from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear log command (**CLR**) – please note that the CLR command clears all logged data, rain, river, battery and temperature!! The log is dumped in ascii format, as shown in section 4.2.1.

DUBVI<CR> Dump the complete internal battery voltage log record.

(The DUBVI command has all the same search syntax as the DUR command.)

---

The "Dump External Battery Voltage log" (**DUBVI**) command, unloads the external battery voltage log from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear log command (**CLR**) – please note that the CLR command clears all logged data, rain, river, battery and temperature!! The log is dumped in ascii format, as shown in section 4.2.1.

DUBVE<CR> Dump the complete external battery voltage log record.

(The DUBVE command has all the same search syntax as the DUR command.)

---

The "Dump Battery Voltages and temperature log" (**DUBVT**) command, unloads the internal and external battery voltage and temperature log from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear log command (**CLR**) – please note that the CLR command clears all logged data, rain, river, battery and temperature!! The log is dumped in ascii format, as shown in section 4.2.1.

DUBVT<CR> Dump the complete internal+external BV + tempC log record.

(The DUBVT command has all the same search syntax as the DUR command.)

---

The "Dump Temperature log" (**DUTMP**) command, unloads the temperature log from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear log command (**CLR**) – please note that the CLR command clears all logged data, rain, river, battery and temperature!! The log is dumped in ascii format, as shown in section 4.2.1.

DUTMP<CR> Dump the complete temperature log record.

The DUTMP command has all the same search syntax as the DUR command.

---

The "Dump All log" (**DUALL**) command, unloads all data from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear log command (**CLR**) – please note that the CLR command clears all logged data, rain, river, battery and temperature!! The log is dumped in ascii

format, as shown in section 4.2.1.

DUALL<CR> Dump the complete log of all parameters.

The DUALL command has all the same search syntax as the DUR command.

---

The "Dump River log" (**DURV**) command, unloads the 4-20mA river level log from the start of the record to the most recent event stored. On completion of successful data retrieval, the memory remains intact until cleared by the clear log command (**CLRV**) – please note that the CLRV command also clears all logged data, rain, river, battery and temperature!! The log is dumped in ascii format, as shown in section 4.2.1.

DURV<CR> Dump the complete 4-20mA River log record.

The DURV command has all the same search syntax ad the DUR command.

---

The "Memory Wrap" (**MW**) command, enables or disables the wrapping of memory. When memory wrap is on, and the historical log becomes full, then the first data stored will be erased one block at a time. (A block of Flash memory holds approximately 400 events, and there are 1023 blocks available.) In this mode memory never becomes full, and the most recent data is always available. It is advisable that when changing the state of the Memory Wrap flag, the existing logged data be erased so that logging can start afresh.

MW<CR> Display the present state of the memory wrap flag
MW=ON<CR> Turn memory wrap on.
MW=OFF<CR> Turn memory wrap off.

**NOTE:** It is best to clear all of memory (using CLR) when changing this flag.

---

The "Clear Record" (**CLR**) command erases the complete memory log of all history – **note** that this command erases the Rain, River, Battery Voltage and Temperature logs. A question will appear to remind the user that all data will be erased – answer y or Y to delete the log and any other key to abort.

CLR<CR> Erase complete log record.
*** This will clear the Rain, River, Battery and TempC Logs *** : Are you sure ? (Y/N) Y

---

The "Clear River Record" (**CLRV**) command erases the complete memory log of all history – **note** that this command erases the Rain, River, Battery Voltage and Temperature logs. A question will appear to remind the user that **all** data will be erased – answer y or Y to delete the log and any other key to abort.

CLR<CR> Erase complete log record.
*** This will clear the Rain, River, Battery and TempC Logs *** : Are you sure ? (Y/N) Y

---


© Copyright

The "Log" (**LOG**) command allows logging to memory, to be turned on or off. This is used to test a logger without disturbing the existing logged data. The LED will still flash and the event will appear on the comms (if EV is on) so the operator can verify the event has been recognised. When the comms cable is removed (or the sleep timer expires), logging is automatically turned on !

| | |
|---|---|
| LOG<CR> | Display the present state of the Log parameter |
| LOG=OFF<CR> | Turn logging off (Events are not logged to memory) |
| LOG=ON<CR> | Turn logging on (Events are logged to memory again) |

### 4.1.9 Miscellaneous (ID, SI, PASSWD, BYE, SLEEP, RESET, VER)

The "Logger Identification" (**ID**) is a unique number embedded in the MiniLog at the time of manufacture and can only be read. (The first 2 numbers are the year of manufacture)

| | |
|---|---|
| ID<CR> | View the logger ID. Eg. MJ110001 |

The "Site Name" (**SI**) variable is used to either identify a specific logger or the location of the logger. This is a variable string up to 16 characters long and can be any alphanumeric character. The user can use this field for whatever they wish.

| | |
|---|---|
| SI<CR> | Display the present site name. |
| SI=Sydney<CR> | Set the site name to "Sydney" |

The password (**PASSWD**) prevents unauthorised access to altering the parameters or clearing the historical log record. Password access is cleared when the comms is unplugged and the MiniLog returns to its sleep mode, or the BYE command is performed.

The password is a 4 character alphanumeric string that is upper / lower case sensitive. New passwords may be entered by first gaining access by entering the existing password, and then immediately entering the password command again with a new password.

| | |
|---|---|
| PASSWD=BOMM<CR> | To attempt access, or change password if access already accepted. |

If the password is set to the special value of ****, then the password function is disabled! That is, the user does not have to enter the password before they change parameters or clear memory. For example :

| | |
|---|---|
| PASSWD=BOMM<CR> | Enable access. |
| PASSWD=****<CR> | Password function disabled. |


© Copyright

This may be reversed by first entering the **** password and then entering a new password. For example :

| | |
|---|---|
| PASSWD=****<CR> | Enable access. |
| PASSWD=BOMM<CR> | Save BOMM as the new password. |

---

If the MiniLog is connected to a modem, then it may have the comms cable permanently connected. In this situation, once the password is entered, access is permanently granted. The "Bye" (**BYE**) command forces the MiniLog to cancel the password access, and also performs the CLEAR1/2/3/4 sequence of commands. (When the sleep timer expires, password access is also cancelled.)

---

The "Sleep" (**SLEEP**) command provides a timer, so that a "Bye" is performed if there is no communications in the preset time. The timer is set in minutes. For example, if "sleep" is set to 5 minutes, and there is no communications for a 5 minute period, then password access will be cancelled, and the CLEAR1/2/3/4 will be performed. When Sleep is set to 0, the function is disabled.

| | |
|---|---|
| SLEEP = 5<CR> | Sets the sleep timer to 5 minutes (Acceptable values are 0 to 9) |

---

The "Reset" (**RESET**) command performs a hardware reset, but does not affect the time, date, parameters or logged data.

| | |
|---|---|
| RESET<CR> | Perform a reset of the MiniLog. Note that this command is equivalent to switching the logger off and then on again. |

---

The "Version"(**VER**) command allows the MiniLog firmware version to be displayed.

| | |
|---|---|
| VER<CR> | Displays the MiniLog firmware version and date. |

---


© Copyright

## 4.1.10 Status Window (ST)

The Status Window (ST) returns a summary of station set-up details together with a report of the present conditions. Each set-up parameter is identified by name followed by its unique command keyword, (parameter abbreviation). The Status window provides a 'plain English' response for visual interpretation when the ST command is issued.

***Command Example***

ST

| | | | |
|---|---|---|---|
| Site(SI): | Sydney | Rainfall Channel ID (CHID): | 0012345 |
| LoggerID(ID): | MJ110001 | Rainfall Log Start: | 22/01/11 |
| Date(D): | 28/03/11 | Rainfall Inc. (INC): | 0.2/01 |
| Time(T): | 10:06:46 | Rainfall Today (TDAY): | 5.2 |
| Baud Rate (BAUD): | 9600 | Rainfall Total (TOT): | 1260.7 |
| Response(RE): | On | Rainfall Units (UD): | mm |
| Event Output (EV): | On | | |
| Events Left: | 421763 | River Channel ID (CHIDRV): | 0000002 |
| Memory Wrap (MW): | Off | River Log Start: | 22/01/11 |
| Go to sleep after (SLEEP): | 5 min | River Last (WL): | 3.726 |
| Logging On/Off (LOG): | On | River Units (U420): | m |
| S/W Revision (VER): | 1.00 | River Height Ref (RvHR)(offset): | 0.417 |
| | | River Trans Ref (TxR)(range): | 10.000 |
| Clear1: | +++~~ | River Trans.Int (TXI)mmm/tt: | 015/05 |
| Clear2: | ATH^M/OK/9 | | |
| Clear3: | | Temperature (TEMPC): | 24.3C |
| Clear4: | | BV+T Log Interval (BVInt)mmm: | 060 |
| | | Battery Volt (BV): | 3.54/12.6V |

---

NOTE : The words "**Rainfall"** and **"River**" in the above Status Window, is the result of the TYPE parameter. This string can be changed to customise the Status Window to your requirements.

Note that the data in the Status Window is grouped to describe each area of the ML1-20, that is "general configuration" on the left, "digital input configuration" at the top right, "4-20mA configuration" at the centre right, and "battery / temperature configuration" at the lower right.


© Copyright

## 4.2 Data Output Format

### 4.2.1 Dump Log Record

The following data represents the historical log record as output from a MiniLog ML1-420 data logger. The example below represents a data record as presented to a computer after invoking a Dump Log Record command (DUR). Each parameter is separated by a 'space' character with each line terminating with a carriage return line feed marker, (< crlf >). Additional housekeeping events, identified as 'plain English' text fields, are automatically logged to the record on the instance of a variety of events. The text fields Record Clear, Time Change, Date Change and Record End are examples of some of the text event indicators.

The contact closure (or bucket tip from a rain gauge) is represented by a time stamp only. Look back through the log to obtain the date of the event. Other dump commands are shown on the following pages.

** Rainfall Record ** **DUR**

| | | |
|---|---|---|
| **Station Set-up Header** | ≡ | **Sydney 0012345 MJ110001 0.2< crlf >** |
| **Logger Start Header** | ≡ | **09:35:23 24/3/11 0 Record Clear< crlf >** |
| | | **10:25:37< crlf >** |
| **Events (time stamp)** | ≡ | **10:27:42< crlf >** |
| | | **16:53:05< crlf >** |
| **Daily Summary** | ≡ | **00:00:00 25/3/11 3< crlf >** |
| | | **15:43:09< crlf >** |
| | | **15:44:23< crlf >** |
| | | **15:45:00< crlf >** |
| | | **22:22:55< crlf >** |
| | | **00:00:00 26/3/11 4< crlf >** |
| | | **22:24:00< crlf >** |
| | | **00:00:00 27/3/11 0< crlf >** |
| **End of Record Marker** | ≡ | **Record End< crlf >** |

| Field | Par. | Parameter Definition |
|---|---|---|
| Station Set-up Header | MELB | Site Name, variable length, user programmable. |
| | 0012345 | Channel ID Number or observational site number, 7 digits, user programmable. |
| | MJ110001 | Logger ID, 6 digits, hard coded by manufacturer, where first two digits "MJ" represent an alphanumeric manufacturer ID followed by a six digit unit number. |
| | 0.2 | Recording Increment, 0.2 millimetres, user programmable. |
| Logger Start Header | 09:35:23 | Logger Start Time, Hour:Minute:Second. |
| | 24/3/11 | Logger Start Date, Day/Month/Year. |
| | 0 | Start Count, event accumulator, 0 counts. |
| | Record Clear | Indicator to identify start event, normally "Record Clear". |
| Event | 10:27:42 | Time Stamp of contact closure, Hour:Minute:Second. |
| Daily Summary | 00:00:00 | Time Stamp check at zero hours, Hour:Minute:Second. |
| | 25/3/11 | Date Stamp check at zero hours, Day/Month/Year. |
| | 3 | Daily event accumulator, (daily total = 3 events). |
| End of Record Marker | Record End | Indicator to identify the end of the log record. |


© Copyright

** River Level / 4-20mA Record ** **DURV**

| | | |
|---|---|---|
| **Station Set-up Header** | ≡ | **Sydney 0000002 MJ110001 1< crlf >** |
| **Logger Start Header** | ≡ | **09:35:23 24/3/11 Record Clear< crlf >** |
| | | **09:45:03 3.529< crlf >** |
| **Events** | ≡ | **10:00:03 3.535< crlf >** |
| **(time + level)** | | **10:15:03 3.543< crlf >** |
| | | **10:30:03 3.552< crlf >** |
| | | **10:45:03 3.567 crlf >** |
| | | **11:00:03 3.563< crlf >** |
| | | **11:15:03 3.558< crlf >** |
| **End of Record Marker** | ≡ | **Record End< crlf >** |

** Internal Battery Voltage Record ** **DUBVI**

| | | |
|---|---|---|
| **Station Set-up Header** | ≡ | **Sydney MJ110001< crlf >** |
| **Logger Start Header** | ≡ | **09:35:23 24/3/11 Record Clear< crlf >** |
| | | **10:00:00 3.55< crlf >** |
| **Events** | ≡ | **11:00:00 3.55< crlf >** |
| **(time + internal BattV)** | | **12:00:00 3.55< crlf >** |
| | | **23:00:00 3.54< crlf >** |
| **Midnight Marker** | ≡ | **00:00:00 25/3/11 < crlf >** |
| | | **00:00:00 3.54 <crlf>** |
| **End of Record Marker** | ≡ | **Record End< crlf >** |

** External Battery Voltage Record ** **DUBVE**

| | | |
|---|---|---|
| **Station Set-up Header** | ≡ | **Sydney MJ110001 < crlf >** |
| **Logger Start Header** | ≡ | **09:35:23 24/3/11 Record Clear< crlf >** |
| | | **10:00:00 12.13< crlf >** |
| **Events** | ≡ | **11:00:00 12.12< crlf >** |
| **(time + external BattV)** | | **12:00:00 12.12< crlf >** |
| | | **23:00:00 12.11< crlf >** |
| **Midnight Marker** | ≡ | **00:00:00 25/3/11 < crlf >** |
| | | **00:00:00 12.10 <crlf>** |
| **End of Record Marker** | ≡ | **Record End< crlf >** |


© Copyright

** Battery Voltage + Temperature Record ** **DUBVT**

| | | |
|---|---|---|
| **Station Set-up Header** | ≡ | **Sydney MJ110001 < crlf >** |
| **Logger Start Header** | ≡ | **09:35:23 24/3/11 Record Clear< crlf >** |
| | | **10:00:00 3.55 12.13 25.1< crlf >** |
| **Events** | ≡ | **11:00:00 3.55 12.12 24.7< crlf >** |
| **(time + internal BattV +** | | **12:00:00 3.55 12.12 24.4< crlf >** |
| **external BattV + temperature)** | | **23:00:00 3.54 12.11 24.2< crlf >** |
| **Midnight Marker** | ≡ | **00:00:00 25/3/11 < crlf >** |
| | | **00:00:00 3.54 12.10 23.1<crlf>** |
| **End of Record Marker** | ≡ | **Record End< crlf >** |

** Temperature Record ** **DUTMP**

| | | |
|---|---|---|
| **Station Set-up Header** | ≡ | **Sydney MJ110001 < crlf >** |
| **Logger Start Header** | ≡ | **09:35:23 24/3/11 Record Clear< crlf >** |
| | | **10:00:00 25.1< crlf >** |
| **Event** | ≡ | **11:00:00 24.7< crlf >** |
| **(time + Temperature)** | | **12:00:00 24.4< crlf >** |
| | | **23:00:00 24.2< crlf >** |
| **Midnight Marker** | | **00:00:00 25/3/11 < crlf >** |
| | | **00:00:00 23.1 <crlf>** |
| **End of Record Marker** | ≡ | **Record End< crlf >** |

** Dump All Records ** **DUALL**

| | | | |
|---|---|---|---|
| **Station Set-up Header** | ≡ | **Sydney MJ110001 < crlf >** | |
| **Events** | ≡ | **1, 24/03/11, 09:35:23, 0.2< crlf >** | **(=0.2mm rain)** |
| **(type, date, time, level)** | | **2, 24/03/11, 09:45:03, 3.529< crlf >** | **(=3.529m river)** |
| | | **3, 24/03/11, 10:00:00, 3.55< crlf >** | **(=3.55V BVint)** |
| | | **4, 24/03/11, 10:00:00, 12.13< crlf >** | **(=12.13V BVext)** |
| | | **5, 24/03/11, 10:00:00, 25.1< crlf >** | **(=25.1C Temp)** |
| | | **2, 24/03/11, 10:00:03, 3.535< crlf >** | **(=3.535m river)** |
| | | **2, 24/03/11, 10:15:03, 3.539< crlf >** | **(=3.539m river)** |
| | | **2, 24/03/11, 10:30:03, 3.546< crlf >** | **(=3.546m river)** |
| | | **1, 24/03/11, 10:37:52, 0.2< crlf >** | **(=0.2mm rain)** |
| | | **1, 24/03/11, 10:39:43, 0.2< crlf >** | **(=0.2mm rain)** |
| **End of Record Marker** | ≡ | **Record End< crlf >** | |

The event types are :

0 = Housekeeping
1 = Rainfall / Digital input
2 = River / 4-20mA
3 = Internal Battery Voltage
4 = External Battery Voltage
5 = Temperature


© Copyright

# 5. Specification

## 5.1 Hardware Specification

| | |
|---|---|
| Microprocessor | Microchip PIC18F2680 nanowatt processor |
| Program Memory | Internal to microprocessor (64K bytes) |
| Program Upgrade | Via RS232 WinComLog Application |
| Data Memory | SST25VF032 32Mbit (=4MB) Serial Flash EPROM |
| Parameter Memory | EEPROM internal to microprocessor (1024 bytes) |
| Events Recorded | 400,000 events, 1 second resolution |
| Real Time Clock | Day/Month/Year Hour/Minute/Second (32768 Hz crystal)<br>Accuracy adjustable under software control |
| Inputs | 1 x Digital input (for rain or flow etc..)<br>(Maximum recording rate = 30 events per second)<br>1 x 4-20mA Analog Input (16 bit A-D sample)<br>1 x external Battery Voltage measurement (10 bit A-D sample)<br>(+ Internal AA battery and temperature measurement) |
| Indicators | LED indicator |
| Connections | 1 x DB9 Female + screwless spring clamp terminals |
| Communications | RS232 Port (Tx, Rx) |
| Power Supply | 1 x Internal 3.6V Lithium AA cell (2 years operation)<br>OR<br>1 x Internal 1.5V Alkaline AA cell (1 year operation)<br>OR<br>1 x Internal 1.2V NiMH AA cell (low self dischg - 6 months)<br><br>External Supply 12V DC nominal (6V to 19V DC)<br>(required to power 4-20mA transducer)<br>(All RS232 inputs diode-ored together with 12V supply) |
| Dimensions | 70mm x 60mm x 40mm (W x H x D) (excludes gland)<br>70mm x 80mm x 40mm (W x H x D) (includes gland) |
| Weight | 200 grams |
| Environmental | -40C to + 70C at 95% RH Non Condensing<br>Aluminium waterproof housing IP67 |


© Copyright

## 5.2 LED Indicator

The LED indicator on the MiniLog ML1-420 will flash once a second. This heartbeat indicates that the MiniLog is alive and well. (Note that the flash is only 1 mS in duration and has an insignificant contribution to the battery life.)

When an external event or communication occurs, the LED flashes much longer. This makes it easy to distinguish an event from the heartbeat. When a 4-20mA sample is in progress the LED flashes at a 5Hz rate.

## 5.3 External Contact Interface

The MiniLog ML1-420 logger includes an interface for an external voltage free contact. The occurrence of an external event causes the logger to wake momentarily, record the event to the historical record, transmit the event on the serial port (if the EV flag is on), update the Total Events and Events Today before going back to sleep.

## 5.4 4-20mA Interface

The MiniLog ML1-420 logger has a 42.9 ohm sense resistor for measuring the 4-20mA current, as well as the ability to switch loop power to the 4-20mA device. The measurement cycle causes the logger to wake, switch power to the 4-20mA transducer, wait the required warm up time, make a measurement, record the measurement to the historical record, transmit the measurement on the serial port (if the EV flag is on) before going back to sleep.

## 5.5 Communications Interface

The communications allows for simple direct connection to a PC. The hardware interface is standard RS232, and the low consumption of the MiniLog means that sufficient power can be extracted from the RS232 handshake lines to power the logger while a communication session is in progress. Seven baud rates can be selected.

## 5.6 Watchdog

The MiniLog incorporates ‘watchdog’ circuitry within the microprocessor to automatically recover from unforeseen software or noise induced failures. The action of a watchdog reset does not affect previously recorded data or any set-up parameters including date and time.

## 5.7 Power Supply

The MiniLog is powered by an internal AA battery, for normal event logging. This can be anything from a NiMH (1.2V) to an alkaline (1.5V) to a lithium (3.0V or 3.6V) – with each type of battery giving a different life. External power is required during a communication session – but this is normally provided through the RS232 handshake lines when an RS232 cable is connected.

External power is required if a 4-20mA transducer is connected - use 6V DC to 19V DC.


© Copyright

## 5.8 System Memory

A fundamental requirement of the logger unit is for sufficient memory capacity to store 400,000 events.

In most cases the MiniLog can be returned to the processing centre via surface mail. The logger's small size and weight means the package returned, conforms with low cost postage tariffs.

The logger application requires three essential memory areas, **Data Memory** for storage of the historical records, **Program Memory** for storage of the application firmware and **Paramter Memory** to store unique station parameters.

## 5.9 System Clock

The clock performance in terms of reliability and maintainable accuracy is of prime importance as the historical record is unusable should time and date errors occur. The clock should maintain an accuracy of better than 20 seconds per month with resolution to one second across an operating temperature range from $-10^{o}$C to $+70^{o}$C. The Time Adjust command allows for automatic software adjustment of the real time clock crystal.

## 5.10 Logger Identification

Each logger has a six digit unique identification number hard coded and accessible as a **read** only system parameter via software.


© Copyright

# 6. Fault Finding

This fault finding guide should be used by the ML1-420 user before they consult the manufacturer to assist with specific problems.

***LED does not flash once a second.***

- If you have attempted to load new software / firmware, then attempt the procedure again.
- The internal battery may be flat. Remove the 4 screws on the top of the MiniLog and remove the top cover exposing the PCB and battery. Use a DVM to measure the battery voltage. An alkaline battery should be about 1.5V and a lithium battery should be between 3.2V and 3.6V If the voltage looks low, then replace the battery.
- If LED still does not flash after the above has been checked, return the logger to the supplier for service.

***No communications from logger.***

- Check if LED flashes when sending a character to the logger. If not, see if the LED flashes in response to an external event. The RS232 handshake lines provide power to the MiniLog – so make sure the RTS and DTR signal are in their hi state – especially if you are using a third party terminal emulation package.
- Check the logger baud rate, number of bits and parity (8/N/1) matches that of the terminal emulation program being used on the computer. If you receive strange characters in response to a carriage return, then the baud rates probably don't match - change the baud rate on the terminal emulation program, and try again.
  Try all 7 baud rates from 1200 to 57600 on the PC.
- Check the Tx, Rx, RTS, DTR and Gnd wiring to the logger from the computer.
- Check that the terminal emulation program is working, by disconnecting the logger and shorting the Tx and Rx wires together, and type on the computer. You should get each character twice on the screen. Try the other available comm ports on the PC.

***What I type on the computer the characters do not appear, but the logger seems to respond OK.***

- Set the third party terminal emulation program "Local echo" to on.

***An external event flashes the LED but nothing gets transmitted.***

- Set the event flag (EV) to on to allow events to be transmitted. However the flag should be off if the logger is connected to an intelligent modem.
- Check that the multiplier (**mm**) in the increment parameter (INC=x.x/**mm**) is set to a reasonable number. Remember that **mm** contact closures represent one event.

***When I type <CR> (Enter ) on the computer the LED flashes but I get no reply.***

- Set the response flag (RE) to on. This flag is used to stop the logger responding to data from an intelligent modem. If you are talking through a modem then this is correct, you will not get a response to a <CR> (Enter ) because the response flag must be left off.

***The logger will not accept my password.***

- Check that you have the correct password, and you are entering it in the correct upper and lower case. The factory default password is "BOMM"
- If still no success, the logger must be returned to the manufacturer, to set a default password. Keep your password written down in a secure place.


© Copyright

***When I enter a parameter I just get a "Syntax Error" reply.***

- Check the exact command syntax by using the on-line help. Type ?<CR> . Now re-enter the parameter with all leading and trailing zeros.

***When I enter a command I just get a "Command Error" reply.***

- Check that the command you are entering is a valid command by using the on-line help. Type ?<CR> and check the exact spelling of the command.

***The external battery voltage read is lower than I expect at 5.84V .***

- The external battery is probably disconnected or completely flat – you are probably seeing the voltage sucked from the RS232 port.

***I don't have an external battery, but it is reading 5.84V .***

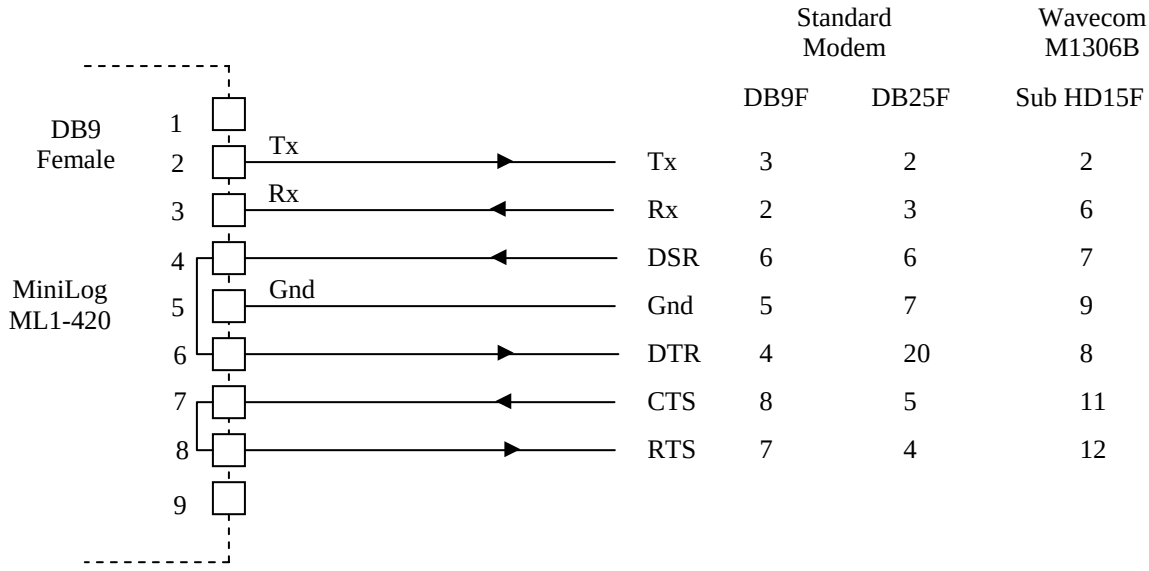
- You are seeing the voltage sucked from the RS232 port – this is normal.


© Copyright

# Appendix A. Interfacing to a Modem

The MiniLog may be connected to a modem to allow remote communications.

The MiniLog only uses Tx and Rx for communications, however, the modem handshake lines **must** also be connected to provide power for the MiniLog during the communication session. These handshake lines are looped together inside the MiniLog as shown.




Hardware Connections - Basic Modem Interface

**Standard Modem Settings**

Before a modem is put into service, the following settings should be programmed into the modem. Simply connect the modem to your PC using the cable supplied with the modem, and run a program such as WinComLog or Hyperterm. Type AT<CR> and you should get an "OK" response. Then set the following commands in the modem :

| | |
|---|---|
| ATE0 | Turn off character echo |
| AT&C0 | DCD is always on |
| AT&D0 | DTR is ignored |
| AT&S0 | DSR is always on |
| ATS0=2 | Auto-answer after 2 rings |
| AT&W | Save these settings (they will be restored on the next power up) |

It is best to turn the MiniLog "RE" parameter OFF when connected to a modem, so that the MiniLog and the modem don't engage in endless "Command Error" conversations.

Some modems require a specific sequence to hangup correctly. Enter these sequences into the CLEAR1/2/3/4 parameters and use the BYE command and then the "Hangup" button to close the communication session.


© Copyright

## Using the Wavecom Fastrack M1306B GSM Modem and the Intercel SAM Modem.

A GSM modem is just like any PSTN modem you may be familiar with, except it communicates via the GSM mobile phone network, rather than the Public Switched Telephone Network (PSTN).

### SIM Card

The GSM modem must have a SIM card installed, the same way your mobile phone has a SIM card. However you can't just use a standard mobile phone SIM card, you must have the card "Data Enabled" – that is you must contact your mobile phone network provider and specifically ask them to "Data Enable" the card. (In Australia the Telstra contact phone number is 1300 131 816.)

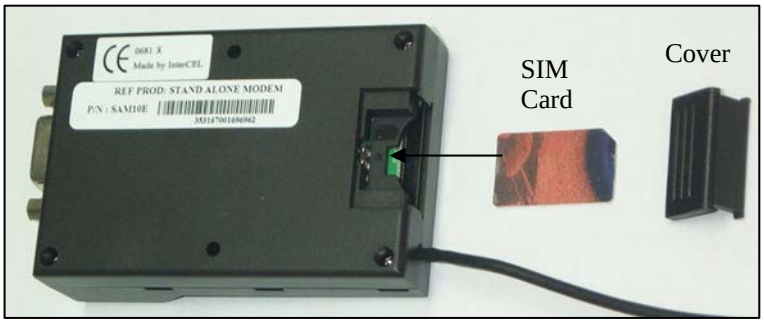
### Wavecom Fastrack :

Push the eject button shown, to make the SIM card holder pop out.

Put the SIM card into the SIM card holder as shown, and insert the SIM card holder back into the modem.

### Intercel SAM :

The SIM card fits into the rear of the SAM modem – so the modem must be unscrewed from its mounting, the cover removed from the modem, the SIM card inserted and the cover replaced.




Connect the antenna and apply 12V DC to the modem.

### LED Indicator

Both the Wavecom M1306B and Intercel SAM modems have a LED indicator that flashes as follows :

| | | |
|---|---|---|
| LED Steady | => Not registered with network | (No SIM card, no signal, no PIN) |
| LED Slow Flash | => Registered OK but not connected | |
| LED Fast Flash | => Connected and communicating | |


© Copyright

## Modem Settings

Before the modem is put into service, the following settings should be programmed into the modem (in the same way as a PSTN modem). Simply connect the modem to your PC using the cable supplied with the modem, and run a program such as WinComLog or Hyperterm. Type AT<CR> and you should get an "OK" response. Then set the following commands in the modem :

| | |
|---|---|
| **ATE0** | Turn off character echo |
| **AT&C0** | DCD is always on |
| **AT&D0** | DTR is ignored |
| **AT&S0** | DSR is always on |
| **ATS0=2** | Auto-answer after 2 rings |
| **AT&W** | Save these settings (they will be restored on the next power up) |

Further advanced settings are required for the GSM modem.

| | |
|---|---|
| **AT+IPR=9600** | Force 9600 baud communications to Minilog |
| **AT+CSQ** | Determine the signal strength. Typical Reply :<br>+CSQ: 26,0<br>(0-10 insuffucient : 11-31 sufficient : 99 no measure available) |
| **AT+CREG?** | Determine the registration status. Typical reply :<br>+CREG: 0,0 Not Registered (no signal or SIM card not installed)<br>+CREG: 0,1 Registered (home network)<br>+CREG: 0,5 Registered (roaming) |

Some SIM cards have PIN access. So enter the PIN code as follows, and then turn off the PIN requirement. (The PIN must be disabled, as there is no way for the MiniLog to enter a PIN)

| | |
|---|---|
| **AT+CPIN=xxxx** | Enter the pin code |
| **AT+CLCK="SC",0,xxxx** | Turn off the PIN requirement |

The Wavecom Fastrack and Intercel SAM modems both recommend that for continued network coverage, they be setup to reset every 24 hours by using the following command :

| | |
|---|---|
| **AT+WRST=1,"024:00"** | Reset every 24 hours |

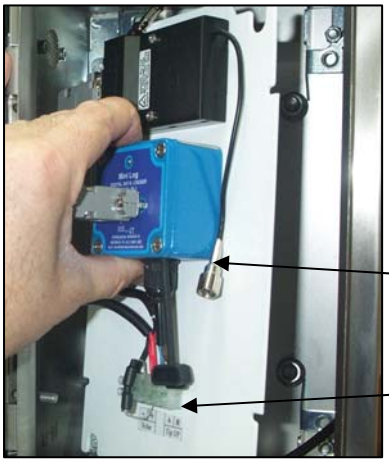
The GSM modem should now be ready to connect to the MiniLog with the appropriate cable (see the connection diagram earlier in this appendix).

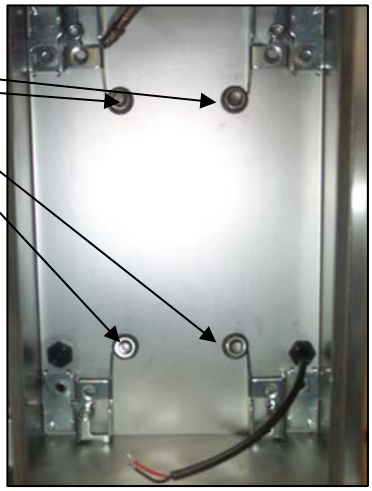
Use WinComLog (Rev2.20 or greater) and enter the phone number of the GSM modem SIM card, then press the "Dial" button. (+++ will be sent to the PC modem to get its attention, and then the ATDTxxxxxxxx command will be sent to perform the dialling to the GSM modem.) You will hear the usual dialling, ringing and connection tones through the modem. When a connection has been made, send a simple command like ?<CR> to check that communications has been established. When the communications session is complete, press the "Hangup" button. (Again +++ will be sent to the modem to get its attention, and then ATH to perform the hangup)


© Copyright

# Appendix B. Installing a RainTrak System

The Hydrological Services "RainTrak" consists of a MiniLog, a Intercel SAM GSM modem, a solar panel, and mounting hardware for a Tipping bucket raingauge. (The user must provide their own 12V, 7Ah battery)






Removing electronics mounting plate

When installing the RainTrak on to a post, the following procedure must be followed:

- Remove the 2 x wires from the solar panel to the terminal block.
- Remove the 2 wires from the tipping bucket to the terminal block.
- Undo the connector from the GSM modem to the aerial.
- Remove the 4 x bolts that secure the electronics mounting plate to the enclosure.
- Remove the electronics mounting plate from the enclosure.
- Position the enclosure on the post, making sure that the solar panel faces roughly north, and do up the 4 nuts, inside the enclosure, that secure the two U-bolts.
- Reinstall the electronics mounting plate.
- Re-connect the aerial to the GSM modem.
- Re-connect the 2 tipping bucket wires.
- Re-connect the 2 solar panel wires.
- Re-install the 12V 7Ah battery.
- Check operation.


© Copyright

The Intercel SAM GSM modem must be unbolted from the mounting plate, as the SIM card fits to the rear of the modem.

Unbolt the modem.

Remove SIM card cover.

Insert the SIM card as shown.

Replace the SIM card cover, and bolt the modem back onto the mounting plate.


© Copyright

# Appendix C. Surge Protection

The ML1-420 has a limited amount of surge protection on the inputs and outputs. If the equipment is installed in a lightning prone area we recommend installing additional surge protection on cables entering the ML1-420 from outside the housing cabinet.

Different suppression is required, depending upon the voltage to be protected.

Figure C.1 and Figure C.2 show suggested methods of protecting equipment against transients. The transient suppressors and the metal cabinets should also be connected to a solid earth at the site.

(NOTE: HS warranty does not cover equipment damaged by surges or transients !)

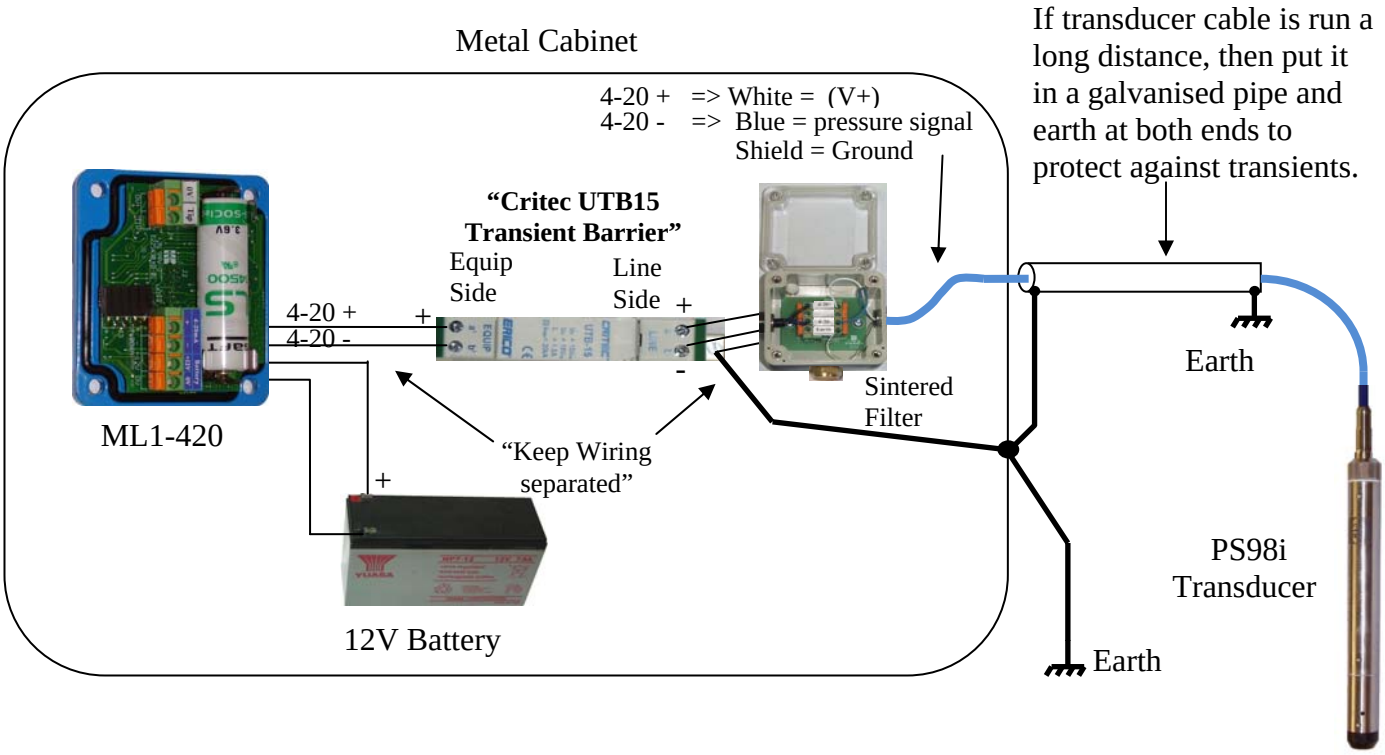



**Fig C.1 "Protection when transducer is located remotely"**


© Copyright

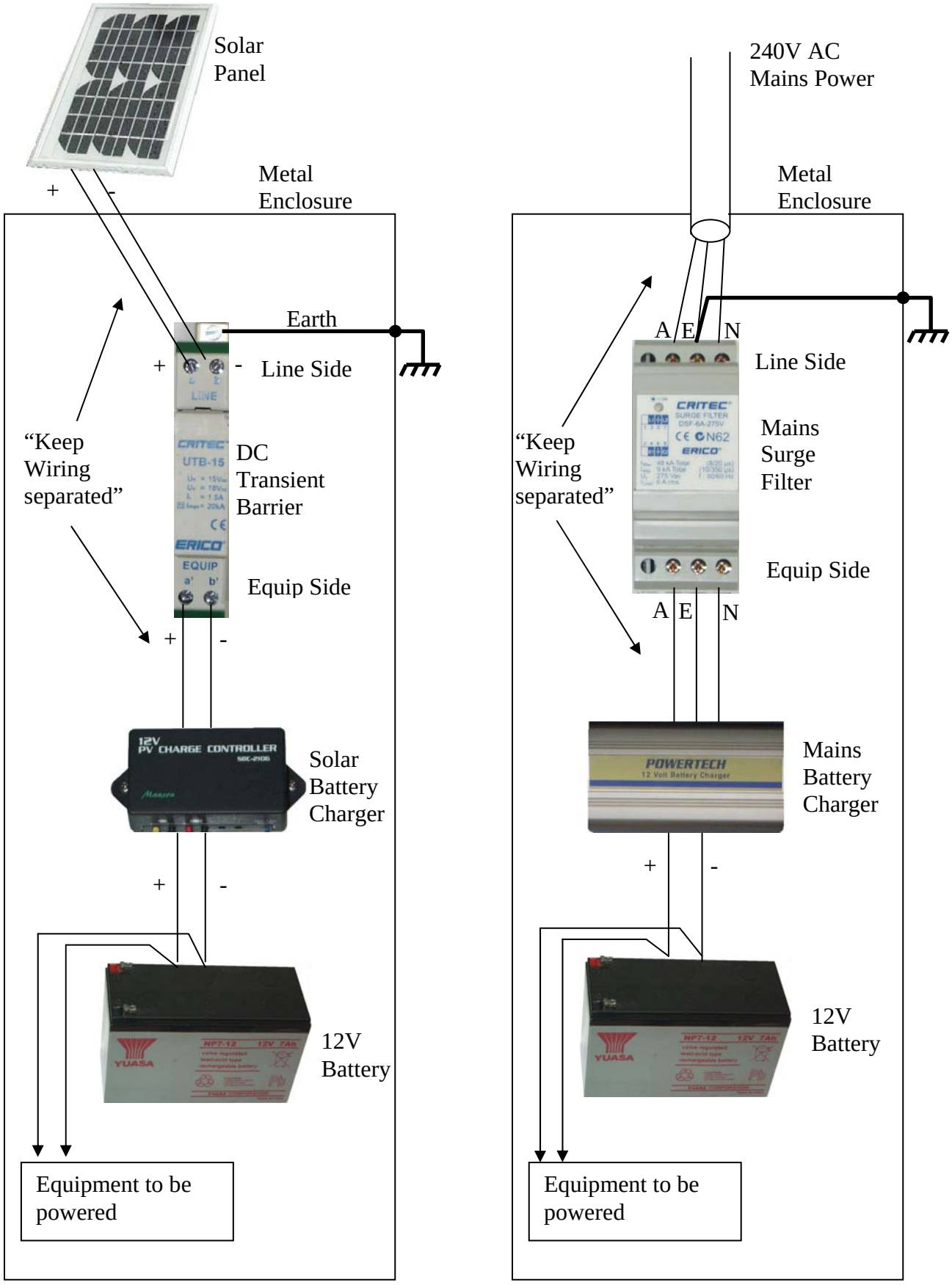



**Fig C.2 "Typical solar or mains powered site"**